TITLE

CABLE-PROCESSING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a cable-processing device with processing stations for processing a cable and having at least one swivel-arm as a feeder to feed the cable to the processing stations.

Usually, the processing stations of a cable-processing machine are arranged in a circle. The greater the number of processing operations undertaken on the cable-ends, the greater the number of processing stations needed, and the greater the radius of the circle in which they are arranged. A greater radius of the circle makes cable-feeders with longer swivel-arms necessary. Long swivel-arms with cable-grippers arranged on their free ends have large masses. In addition, there is the mass of the gripper and of the gripper-drive arranged in the gripper.

A disadvantage of the known feeders is that with longer arms larger drives are needed. Larger drives in turn require a larger cable-processing machine overall.

SUMMARY OF THE INVENTION

The present invention concerns an apparatus that avoids the disadvantages of the above-described known device and creates a cable-feeder in which the ratio of the moved mass of the swivel-arm, including gripper, to the mass of the moved cable is low.

The advantages achieved by the device according to the present invention are that with its mass reduced, the swivel-arm can be built longer. The lighter swivel-arm can be moved faster by the same drive. Furthermore, with the gripper-drive arranged outside the gripper, the mass of the gripper to be moved is substantially reduced. The gripper construction according to the present invention comprises a low-mass conversion of a linear force into two rotational movements with opposite and symmetrical paths. The minimum distance between the cable-axis and the lowest point of the gripper with the gripper-jaws open which is required when advancing the cable is provided by the gripper construction according to the present invention. Both gripper-jaws rotate around a concentric axis of rotation, the change in height for gripping cables of different diameter thereby being minimized.

DESCRIPTION OF THE DRAWINGS

The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

Fig. 1 is a top plan view of a cable-processing machine with two swivel-arms according to the present invention;

Fig. 2 is an enlarged perspective view showing details of the swivel-arms with gripper shown in Fig. 1;

Fig. 3 is an enlarged perspective view showing details of the swivel-arm linear drive shown in Fig. 2;

Fig. 4 is an enlarged perspective view in partial cut-away of the gripper with gripper-drive shown in Fig, 2;

Fig. 5 is an enlarged perspective view in partial cut-away of the gripper of Fig. 4 shown in a closed position;

Fig. 6 is a view similar to Fig. 5 showing the gripper in an open position; and

Fig. 7 is a view similar to Fig. 2 showing an alternate embodiment of the gripper-drive in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a cable-processing machine **1** with a cable-advancer executed as a belt-drive **2**, the belt-drive **2** feeding an electrical cable **3** to a swivel-arm feeder having a first swivel-arm **4** with a first gripper **5**. By means of first drives **6**, the first swivel-arm **4** can be set into a swiveling motion symbolized by an arrow **P1**, and/or into a linear motion symbolized by an arrow **P2**. By means of cutting/stripping knives **7**, downstream of the first swivel-arm **4**, the cable **3** can be cut off and/or stripped of insulation.

Further, the cable-processing machine **1** has a second swivel-arm feeder having a second swivel-arm **8** with a second gripper **9**. By means of second drives **12**, the second swivel-arm **8** can be caused to move in a swiveling motion symbolized by an arrow **P3** and/or in a linear motion symbolized by an arrow **P4**. By means of the rotational motion **P1** and the linear motion **P2**, the first swivel-arm **4** functions as a feeder serving leading cable-ends **3.1** to adjacent ones of processing stations **10** (for example, crimping presses

and/or seal mounters) arranged to the side of the longitudinal cable-axis. By means of the rotational motion **P3** and the linear motion **P4** imparted to it by the second drives **12**, the second swivel-arm **8** functions as a feeder serving trailing cable-ends **3.2** to adjacent ones of the processing stations **10** (for example, crimping presses and/or seal mounters) arranged to the side of the longitudinal cable-axis. After the leading cable-end **3.1** has been processed, the cable **3** is transported further by means of a transportation belt **11**. The second gripper **9** grasps the trailing cable-end **3.2**, after which a cable length **3.3** of the cable **3** is cut off, and the trailing cable-end **3.2** is stripped of insulation and fed to the adjacent processing stations **10**. After the trailing cable-end **3.2** has been processed, the cable length **3.3** goes into a tray **13**.

Fig. 2 shows details of the first swivel-arm **4** with the first gripper **5**. The construction of the second swivel-arm **8** with the second gripper **9** is identical to the construction of the first swivel-arm **4** with the first gripper **5**. The first drives **6** consist of a drive **6.1** for generating the swiveling motion **P1**, and of a drive **6.2** for generating the linear motion **P2**, of the swivel-arm **4**. The drive **6.1** has a drive-pinion **6.11** that is driven by a motor **6.10**, and a shaft-encoder **6.12** registering the motion of the pinion. By means of belts **6.13**, the rotational motion of the drive-pinion **6.11** is transferred to a belt-pulley **6.14** which is a component of a turntable **6.15** on which the drive **6.2** for the linear motion **P2** of the swivel-arm **4** is arranged. The first swivel-arm **4** is held rotatably about an axle **14.1** in a bracket **14**, with spring-force acting counterclockwise on the swivel-arm **4**. For the purpose of inserting the stripped end of the leading cable-end **3.1** into, for example, a crimp contact **15**, during the crimping operation a force **P5** exerted by a crimping press (not shown) on the gripper **5** acts against the spring-force, the swivel-arm **4** executing with the gripper **5** a rotating motion in a clockwise direction. The leading cable-end **3.1** is held by a first gripper-jaw **16** and a second gripper-jaw **17** of the gripper **5**. The jaws **16, 17** are arranged rotatably about an axle **18** and are opened and closed by means of gears **19**.

Fig. 3 shows the drive **6.2** for the linear motion **P2** of the swivel-arm **4**. The swivel-arm **4** is guided by means of a linear guide **6.23** arranged on the turntable **6.15**, with a prism-shaped bearing **6.21** guiding a linear guide **14.3** of the swivel-arm **4**. A pinion **6.22** of the motor **6.10** arranged on the turntable **6.15** engages with a rack

arranged on the linear guide **14.3**, the rotational motion of the pinion **6.22** being converted into the linear motion **P2**.

Fig. 4 shows the first swivel-arm **4** with first gripper **5** and a gripper-drive arranged on or in the swivel-arm **4**, the gripper–drive consisting essentially of an actuator **20**. Serving to transmit force to the gear **19** is a rod **21**. The actuator **20** can be, for example, a pneumatic cylinder, which can be supplied with compressed air through a connection **20.1**. The rod **21** can also be actuable by means of an electric actuator (not shown) substituted for the pneumatic actuator **20**. The actuator **20** actuates the rod **21**, made for example of aluminum, in the directions symbolized by a double-headed arrow **P6**. At one end, the rod **21** is connected to the actuator **20** arranged on the swivel-arm **4**, and at the other end, the rod **21** is connected to the gear **19** of the gripper **5** which is arranged in a housing **22**. The rod **21** is surrounded by a tube **23** of the swivel-arm **4**, which tube can be made for example of plastic.

Fig. 5 and Fig. 6 show the construction of the first gripper **5**, Fig. 5 showing the gripper **5** in a closed position and Fig. 6 showing the gripper **5** in an open position. The gear **19** consists of a bevel-gear **24** supported by means of an axle **24.1** in a bearing on the housing **22** and having a lever **25** (Fig. 6), on which an axle **26** is arranged. The rod **21** is connected in an articulated manner to the axle **26**. The bevel-gear **24** engages with a bevel-gear **27** connected with a gripper-lever **28** of the first gripper-jaw **16** and with a bevel-gear **29** connected with a gripper-lever **30** of the second gripper-jaw **17**. Both gripper-levers **28**, **30** are held in an articulated manner on the axle **18**. The cable-center of the gripper **5** is therefore independent of the cable diameter and remains stationary.

By means of the gear **19**, the linear motion **P6** of the rod **21** is converted into two rotational movements with opposite, symmetrical paths, the actuator **20** pulling the rod **21** to close the gripper-jaws **16**, **17** and hold the cable-end **3.1**, and pushing the rod **21** to open the gripper jaws **16**, **17** and release the cable-end **3.1**.

In the exemplary embodiment shown, the gripper **5** is arranged at one end of the swivel-arm **4** and the actuator **20** is arranged at the other end of the swivel-arm **4**. Depending on the actuator **20** (pneumatic, electric, etc.), and depending on the rod **21** (material, shape, dimensions, etc.), and taking into consideration the optimized total moved mass of the swivel-arm **4**, the actuator as shown in Fig. 7 can also be arranged closer to the gripper **5**. In Fig. 7, an actuator **20'** is positioned between a first swivel-arm

first portion **4a**, extending from the bracket **14**, and a first swivel arm second portion **4b**, attached to the gripper **5**.

In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent its preferred embodiment. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.